The American Biology Teacher

OCTOBER, 1955

VOL. 17, NO. 6

Protozoa Experiments

Waterfowl Management

Science Teaching Improvement

TABLE OF CONTENTS

Protozoa in the General Biology or Zoology Course .... T. M. Sonneborn 187

Waterfowl Management in the Pacific Flyway .... David B. Marshall ... 191

Awards for Students in Science and Mathematics 196

AAAS Science Teaching Improvement Program .... John A. Behnke 197

Biology in the News .... Brother H. Charles F.S.C. 200

The Nominating Committee Reports 201

Constitution Revisions 204

COVER PHOTOGRAPH

The "business end" of a large (4 inch) Cecropia caterpillar. Praktiflex with an f3.5 Xenar lens on plus X film at 1/30th at 5.6 using photofloods. Photograph by Charles F. Walcott, Marblehead, Massachusetts.

THE AMERICAN BIOLOGY TEACHER

Publication of the National Association of Biology Teachers.

Issued monthly during the school year from October to May. Entered as second class matter October 20, 1954, at the post office at Danville, Ill., under the Act of March 3, 1879.

Publication Office—Interstate Press, 19 N. Jackson St., Danville, Ill.

Co-Editors—RICHARD ARMACOST, Department of Biological Sciences, Purdue University, West Lafayette, Ind.; PAUL KLINGE, Howe High School, Indianapolis 1, Ind.

The Purdue University address will be the official editorial office. Manuscripts and all publication material may be sent to either of the Co-Editors.

Managing Editor—MURIEL BEUSCHLEIN, 6431 S. Richmond, Chicago 29, Ill.

Subscriptions, renewals, and notices of change of address should be sent to the Secretary-Treasurer, PAUL WEBSTER, Bryan City Schools, Bryan, Ohio. Correspondence concerning advertising should be sent to the Managing Editor.

Annual membership, including subscription, $3.75, subscription to Journal, $3.75, outside United States, $4.50, individual copies, $.50.

MEMBERSHIP APPLICATION

NATIONAL ASSOCIATION OF BIOLOGY TEACHERS

Name ______________________
(Please Print)

Address ______________________

____

Dues: $3.75 a year, including subscription to

THE AMERICAN BIOLOGY TEACHER
For one year (8 issues)

Send application to:

Paul Webster, Secretary-Treasurer
Bryan City Schools, Bryan, Ohio

Protozoa in the General Biology or Zoology Course[1]

T. M. SONNEBORN
Department of Zoology, Indiana University

The Protozoa are so fascinating and attractive that the instructor has no problem at all with regard to arousing interest in them. His problems are chiefly to select and arrange the subjects and materials, to use suitable methods, and to make the most of his pedagogical opportunities. These are the problems dealt with here. At the end of this paper I shall make some comments on how the Protozoa can be used to let the student discover that he can observe Nature and make discoveries himself, and on how one can foster the development of enthusiasm for this. That I consider the greatest educational opportunity provided by work with the Protozoa. The rest of this paper is devoted to setting forth an arrangement of subjects and materials, with suitable methods. This arrangement is based on the principle of proceeding from the visible to the microscopic, from the more to the less familiar, from easier to more difficult observations, from what is obviously important to what is less obviously—but no less truly—important. As will appear, my proposals differ greatly from the usual procedure of starting and ending with Euglena, Amoeba, Paramecium and perhaps Plasmodium. For convenience, the proposals will be presented in the form of three units of study, each consisting of one lecture (or more) and one laboratory period (or more).

The lecture of the first unit has two purposes: to show what large consequences in the non-living world follow from small causes in the living world, and how; and to point out the major differences between plants and animals. To accomplish this, attention is focussed on two groups of Protista, the Foraminifera and the Diatoms. The great consequences that follow from accumulation of Foram shells can be illustrated by photographs of the Great Pyramids of Egypt, the Chalk Cliffs of Dover, and a limestone quarry or a large limestone building such as Rockefeller Center in New York. To bring home how these large results are achieved by microorganisms, a few simple calculations should be made: the numbers of individuals involved, by using the magnitude of the deposits and the size of a single shell; the time involved by using the rate of deposition; and the basic conception of biological amplification through the logarithmic increase of organisms, by using the number of offspring per life cycle and the succession of life cycles. The Diatoms can be handled in the same way, discussing deposits of diatomaceous earth and their uses in building materials, insulation, filters, and so on. The role of microorganisms in the formation of oil deposits and the use of indicator Foram shells in discovering their locations should be pointed out. Finally, the differences between Forams and Diatoms may be used to illustrate differences between plants and animals.

The accompanying laboratory should begin with examination of the large (about one inch diameter) fossil Forams from the pyramids, followed by other fossil Forams from limestones selecting samples of decreasing size down to the microscopic species. These materials are obtainable from biological supply houses, from State Geological Surveys and from university Geology Departments. Diatoms, abundant in local fresh (and salt) waters (also obtainable from supply houses) are all microscopic in size and should be examined for their exquisite markings and to begin to grasp the enormous variety, abundance, and richness of the world of microorganisms.

The second unit deals with the relations of Protozoa to other organisms, especially to

[1]Contribution 597, Department of Zoology, Indiana University.

Man. Three principal relations should be stressed: the Protozoa as agents of disease, as symbionts, and as elements in food cycles. Plasmodium, Trypanosoma and Endamoeba illustrate the Protozoa as agents of disease; the Flagellates of the hind-gut of termites and the Ciliates of the rumen of cattle illustrate the Protozoa as symbionts; and the use of Protozoa as food for aquatic organisms tells their position in food cycles. The opportunity should not be missed here to bring home some of the most important unique features of the Protozoa: that they include a vast range of evolutionary development from forms (such as Amoeba) that are extremely simple in structure and life cycle to forms that are astonishingly complex in structure (the termite Flagellates and cattle Ciliates) and life cycle (Plasmodium); that this evolution has proceeded on a different path from that of higher organisms by being accomplished without resort to multicellularity; and that a single life cycle may include many separate "individuals."

The accompanying laboratory period should be devoted to at least one of the parasites (Plasmodium, if only one) and to either the termite Flagellates or the cattle Ciliates (both, if possible). The difficulties of studying the parasites—their small size and spotting them in the host's tissues—are real; but good slides of stained specimens are available from the biological supply houses and the instructor should find and set up demonstrations of the main stages for the students to examine. On the contrary, the symbionts of termites and cattle are abundant, large, and readily examined, and provide as exciting a laboratory exercise as can well be imagined. If a slaughterhouse is available, one can arrange to obtain rumen contents of freshly killed cattle the same day as the laboratory period. The material of several rumens should be put at once into thermos bottles and used as soon as possible in the laboratory. If you cannot collect your own termites, your local Termite Control company will surely be able to provide them. The termites can be kept a long time in loosely closed containers provided with moist filter paper and rotting wood. Avoiding winged individuals and soldiers, let each student pull out a hind-gut with tweezers into 0.3% Ringer solution, tease the gut apart

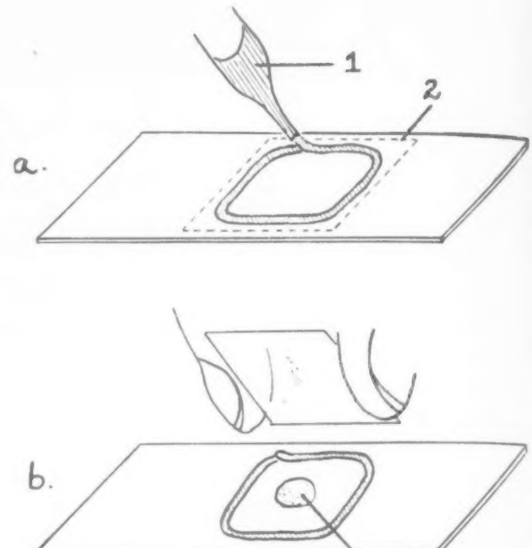

Figure 1. The vaseline-ring preparation. a. Making the ring. (1) the medicine dropper with finely drawn out tip, containing vaseline being extruded in a ring on the glass slide. (2) dotted outline of a coverslip on a piece of paper under the slide. b. Adding culture and coverslip (held between fingers and dropped squarely on the vaseline ring). (3) a drop of culture to be examined. This should be small enough so as not to occupy the whole space under coverslip in the case of samples of free-living Protozoa, but should nearly fill the space in the case of parasitic and symbiotic Protozoa. c. Tapping down the coverslip gently with a pencil until contact is made with all parts of the vaseline ring and with the sample of culture. The vaseline pipet must be gently warmed before using to soften the vaseline; the warmth of your hand held around the part of the pipet containing the vaseline, including the tip, is the best method, though slow. Preparations to be kept for several days should include a little nutrient.

with needles, and examine samples. Both the rumen samples and the termite gut samples—indeed, all living materials—are best studied in a vaseline-ring preparation (see Figure 1).

The third and final unit should—at last—come to the free-living Protozoa, including the three commonly used genera. Here the widest range of choices is available both for

the lecture and the laboratory: (1) classification down to the more common orders; (2) nutrition and feeding; (3) behavior and reactions to stimuli; (4) development, sexuality and life cycles; (5) heredity; and (6) evolution. It is of course impossible to deal satisfactorily with all of these in one lecture and laboratory. On the whole, items 4, 5, and 6 are least feasible in the laboratory time available; they might therefore be dealt with only in the lecture and only in a general way. On the other hand, items 1, 2, and 3 are suitable for the laboratory and need not be dealt with in the lecture at all. Here only hints for the laboratory work will be mentioned.

To work at all with free-living Protozoa, one must first know how to find them and handle them. Quiet waters rich in decaying organic matter—such as pasture ponds—provide the richest cultures both as to diversity of species and abundance of individuals; but garden pools, cemetery urns, bird baths and even gutters and the quiet side-pockets of streams yield good material. In collecting, use wide-mouthed bottles or jars and fill them with leaves, plants and sticks taken from the water. Then add water from near the edge and surface of the pond. Let the material settle in the containers overnight. Many Protozoa aggregate just below the surface of the water, especially around the edges, and on the surfaces (upper and lower) of the vegetation. These are usually the best regions to examine, but others should also be sampled. The collections may be enriched or subcultures made with organic infusions of many kinds. Boil for about 10 minutes 0.25 to 1.0 gm. of hay, wheat, rye, rice, oats, lettuce, manure, or malted milk per 100 ml. of water; filter; and leave exposed to air for a day (to get a cloudy growth of bacteria) before using.

Examination of samples from such collections or cultures, using the vaseline ring technique, provides a sufficient means of becoming acquainted with the variety of free-living Protozoa: their structure, locomotion, and feeding. Addition of methocel to the preparation facilitates observation of the faster moving species, but often at the expense of some distortion. The two most convenient stains to use are acetocarmine for nuclei and a mixture of Sanford's red ink with a blue ink for cilia and trichocysts. The problem of finding the names of the observed organisms is a difficult one and, in my opinion, should not be unduly stressed. One clever high school biology teacher in Indianapolis lets the students invent names that seem appropriate to the striking features of the organisms and the whole class uses these more meaningful names. If baptism can be made to acquire meaning rather than involve a wasteful and discouraging loss of precious time, why not let it do so? The creature's the thing, not its name.

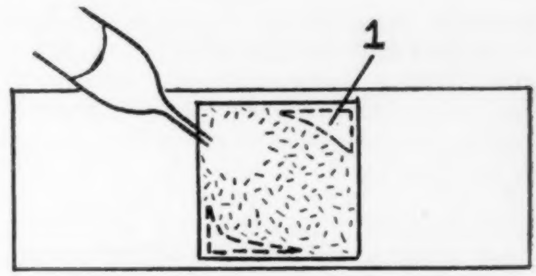

Figure 2. Open preparation for study of reaction to chemicals (modified after Jennings). (1) fragment of cover-glass lying between slide and whole cover-slip. The minute short lines represent Protozoa in the preparation under the coverslip. A finely drawn-out medicine dropper or pipet containing the chemical to be tested, is inserted under the cover glass and a small amount of the chemical (without air-bubbles) is squeezed out by gentle pressure on the bulb. The nearer to the center of the preparation the chemical is deposited, the better. The pipet is then withdrawn and the behavior of the Protozoa observed under the microscope.

Study of behavior will naturally start with locomotion and feeding. The amoeboid, flagellate and ciliate modes of locomotion should be compared, along with the associated mechanics of feeding. If you are fortunate enough to encounter Frontonia, Dileptus, Didinium or a Suctorian, their special techniques of feeding will repay observation. Reactions to stimuli can be studied noting orientation, migration, and aggregation of particular kinds of Protozoa in samples of cultures subjected to simple treatments. The following are easy to try: (1) direct a beam of cool light to one part of a culture for an hour or more; (2) pour a culture into a vertical tube; (3) fill a horizontal container and heat one end to 45° C., while the other end is embedded in ice; (4) place electrodes at opposite ends of a culture and pass a gentle current through it. A little more skill is required to observe reactions to chemicals, as illustrated in Figure 2. Place a few drops of a rich culture

on a slide, add at the sides a few bits of broken cover glass and cover the whole with a cover glass. With a medicine dropper drawn out into a fine tip, introduce into the preparation (under the cover glass) a drop of the chemical to be tested, e.g. 0.1 to .25% salt, .002 to 0.2% acid, or 20% sugar solution. Then note the reactions of the Protozoa as they approach or enter or try to leave the introduced droplet. Finally, with larger Protozoa, such as Stentor or the colonial forms (especially Zoothamnium and Carchesium), observe the effects on the individual and on the colony of gentle touching with a glass needle.

At the beginning, I said I would comment on the greatest educational opportunity provided by the study of Protozoa: the opportunity for the student to discover that he can observe Nature and make discoveries and to acquire enthusiasm for this. However, some of the ordinary rules of teaching must be sacrificed if that is to be achieved. One must not over-direct or insist on drawings or observations that are "correct" according to the "authorities." Every experienced investigator knows how difficult it is to make faultless observations when one doesn't know what to expect. Why then demand them of a novice? To cultivate direct observation and discovery, reward *them*—not freedom from "error"—with top grades. Don't even "correct" the "errors" if they are *bona fide;* at this stage, correction may discourage honest observation. For an appreciation of the importance of these attitudes, I am indebted to the greatest teacher I ever had, E. A. Andrews of Johns Hopkins; to them and to him I owe my own interest in Biology and the Protozoa.

Finally, I recommend considering whether—in the interest of giving each student his proper grade—it is wise to shut each one up within himself and cut off exchanges with each other. I think not. One student may often be stimulated by what another student discovers and imparts to him. And, in the imparting, enthusiasm is generated. Let the students stimulate each other—they may well be each other's best teachers—and then watch their interest, their enthusiasm and their powers grow. In these ways, the Protozoa—so eminently suitable for direct observation and discovery—will foster the attainment of the highest educational objectives.

References

Beale, G. H. (1954). *The Genetics of Paramecium aurelia.* Cambridge University Press.

Calkins, G. N. and F. M. Summers (Editors) (1941). *Protozoa in Biological Research.* New York: Columbia University Press.

Hegner, R. (1938). *Big Fleas Have Little Fleas.* Baltimore: Williams & Wilkens Co.

Hegner, R. and J. Andrews (editors) (1930). *Problems and Methods of Research in Protozoology.* New York: MacMillan Co.

Huxley, T. H. On a Piece of Chalk. (In Huxley's Collected Essays; also in *The Autobiography of Science*, edited by F. R. Moulton and J. J. Schiffers (1945). New York: Doubleday, Doran and Co.

Jahn, T. L. (1949). *How to Know the Protozoa.* Dubuque: Wm. C. Brown Co.

Jennings, H. S. (1920). *Life and Death, Heredity and Evolution in Unicellular Organisms.* Boston: Gorham Press.

Jennings, H. S. (1923). *Behavior of the Lower Organisms.* New York: Columbia University Press.

Kudo, R. R. (1946). *Protozoology.* Springfield: C. C. Thomas.

Manwell, R. D. (1953). What should beginning students be taught about the Protozoa? Turtox News *31* #8.

Needham, J. G. (Editor) (1937). *Culture Methods for Invertebrate Animals.* Ithaca: Comstock Publ. Co.

Sonneborn, T. M. (1950). Paramecium in Modern Biology. Bios *31*:31

Wichterman, R. (1953). *Biology of Paramecium.* New York: Blakiston Co.

Importance of Grass

An Illinois Tech professor, Milton E. Parker, says that with all our food surpluses we only have a two week supply of superior quality protein foods available. He emphasizes the importance of milk because of its protein content.

"Maybe you have been overlooking the grasses in your biology teaching," Dr. Parker says. They provide more organic matter to the soil than any other crop, and are the bulk of nourishment for dairy cattle and poultry. Their importance for the land needs re-emphasis.

Biology Teacher Increase

There was an increase of about 5% in the number of 1955 college students completing requirements for biology teaching certificates (over 1954). If experience is any criterion, however, only about 45.4% of the graduates will accept teaching jobs.

Waterfowl Management in the Pacific Flyway*

DAVID B. MARSHALL, Sacramento National Wildlife Refuge, Fish and Wildlife Service, U. S. Dept. of Interior, Willows, California

Biologists, like other scientists, so often become engrossed in their subject for the sake of science, that they overlook the application of their field to man's needs. This paper covers just one phase of applied biology in the field of wildlife management.

Over two million citizens of our nation went afield to hunt ducks and geese last year. This is five times as many as pursued this sport in 1935. Despite this heavy increase in hunters, last year's waterfowl hunter was allowed to shoot as many or more ducks than a few years ago, and had one of the longest seasons in years. It has been said that man harvests more waterfowl today than during the market-hunting years of a half century ago.

But that is not all the story. When our forefathers settled our nation, it is estimated there were 120 million acres of marshland, but today through agricultural development and drainage, the amount of waterfowl habitat has shrunken to just one-fifth that former figure.

How are we maintaining a waterfowl population on a more or less steady basis in view of these facts? The answer is through modern game management.

True, we have been having a series of good waterfowl production years after the drought years of the 1930's, and man has been giving attention to breeding areas both in the United States and Canada. But there are other factors in addition to breeding areas that are essential to maintaining a sound and healthy waterfowl population.

Let us take the Pacific Flyway as an example. It is one of four lanes of travel by waterfowl that are set up across our continent for administrative and management purposes. In the United States this flyway embraces the states of Washington, Oregon, California, Idaho, Nevada, Arizona and parts of Montana and Utah. Fig. 1 shows, to the best of present day knowledge, the areas in which the ducks of this flyway are produced. Fig. 2 shows how different the distribution of these birds is by January.

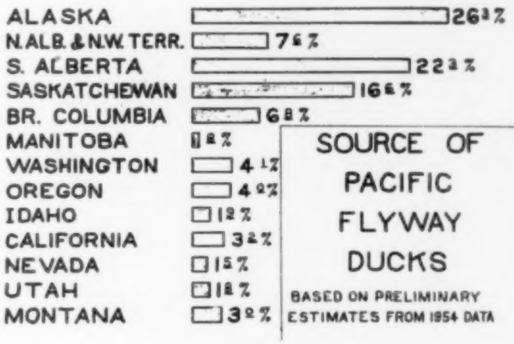

FIGURE 1.

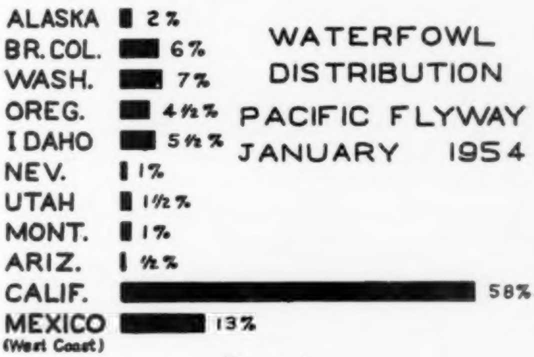

FIGURE 2.

Basic to caring for these birds in the United States is a sound system of refuges and waterfowl management areas without which we could not hope to maintain a waterfowl population. These areas are strategically located in each of the main centers of waterfowl abundance. Fig. 3 shows the principal waterfowl refuges operated by the U. S. Department of the Interior, Fish and Wildlife Service, in this area. Other areas are maintained by the state game departments.

*A written version of illustrated talk presented to N.A.B.T. at the annual meeting of The American Association for the Advancement of Science at the University of California, Berkeley, December 28, 1954.

FIGURE 3. Principal waterfowl refuges administered by the U. S. Fish and Wildlife Service in the Pacific Flyway states.

Each of these refuges carry out one or more of the following functions:

1. Provide protection. The existence of places where waterfowl can feed and rest unmolested during the hunting season is essential. Without some place for the birds to go under modern conditions of heavy hunting pressure, no area can hold waterfowl. Several refuges are also strategically located to provide protection to a rare species.

2. Provide habitat for breeding, feeding and resting.

3. Help draw birds from agricultural crops where damage would otherwise take place.

4. Provide recreation. This may be for the bird watcher, nature photographer, or fisherman. Public hunting is often permitted on a portion of a refuge where the need of a public hunting area is demonstrated and such would not interfere with the objectives put forth under the previous three functions.

Let us elaborate with regard to several of the more important of these Pacific Flyway refuges and the areas in which they are located. We will see how these basic functions are fulfilled.

The Upper Klamath Basin, located in Northeastern California and an adjoining portion of Oregon is the most critical single area in the Pacific Flyway. It is a gathering point during the spring and fall migration for waterfowl that come down from the many areas to the north. Located in the Klamath Basin are the Tule Lake and Lower Klamath National Wildlife Refuges. These two refuges account for approximately half of the Pacific Flyway waterfowl population during the month of October. Although they are relatively large, these refuges make up only a fraction of the waterfowl habitat that was once present in the Klamath Basin. To partially offset this factor, these two areas are intensively managed. Ninety-two miles of dikes impound marsh and lake waters for the production of natural food plants. Controlled waters behind these dikes have greatly reduced the avian botulism or food poisoning that killed ducks by the tens of thousands here in past years.

In addition to the production of such natural food plants as sago pondweed (*Potamogeton pectinatus*), refuge personnel here are engaged in an extensive farming program. The 24,000 acres of water and marsh here won't even begin to feed several million ducks and geese. The cultivated crop raised to feed these birds in largely barley (*Hordeum vulgare*). Crop land of farmers adjoining the refuges is also largely in barley. Refuge barley serves two purposes. It not only feeds the birds, but also prevents a serious economic loss to farmers by controlling bird damage to their fields. Through scaring devices employed by farmers, the birds soon learn which barley is intended for their use. Around 7,000 acres of grain are left unharvested for the birds each year on the Tule Lake and Lower Klamath National Wildlife Refuges. This is enough grain to cover over 10 square miles.

Pintails and mallards, which make up almost 60% of the Pacific Flyway duck population, move out onto dry ground to feed and eventually consume this barley along with snow and white-fronted geese and several other species.

During the hunting season, the Tule Lake area is alive with hunters from all over the west. A survey showed Tule Lake hunters expended approximately $230,000 for shot gun shells alone during the 1954-55 waterfowl

FIGURE 4. Manipulation of water levels on refuge ponds produce find stands of waterfowl food plants, as illustrated by this growth of wild millet on a California refuge.

season. Barley stubble on private ground along the public hunting areas on the refuges afford some of the finest goose shooting in the nation.

The Klamath Basin refuges are also one of the top producers of waterfowl in the United States. In 1954, 147,000 geese, ducks and coots took wing for the first time from these refuges.

As winter closes in on the Klamath Basin and its lakes become frozen, the hordes of waterfowl move south, principally to the Central Valleys of California. There they intermingle with other waterfowl which had entered Central California previously, some pintails having arrived in the Sacramento Valley as early as August. Usually during November, the key area of the Pacific Flyway switches from the Klamath Basin to the Central Valleys, particularly the Sacramento.

December and January find the Sacramento and San Joaquin River drainages supporting over 50% of the flyway population. Only about 15% of the flyway moves into Mexico.

Located in the Sacramento Valley are the Sacramento, Colusa and Sutter National Wildlife Refuges and the state of California's Gray Lodge Waterfowl Management Area. These four areas are vitally important in providing protection during the hunting season, there being practically no other sites with water in the Sacramento Valley where ducks and geese can settle down without being shot at during the hunting season. These four areas also prevent crop damage by ducks and geese that would be of tremendous magnitude were it not for their existence. Before drainage and diking, the Sacramento Valley contained several hundred thousand acres of waterfowl habitat. Today almost this entire acreage is devoted to agriculture. A major crop of this area is rice, a grain which grows in water. Flooded grain is a most tempting dish for a duck. On the other hand, rice is a most expensive crop to produce. A concentration of pintails and mallards can lay waste a field of rice in a matter of days if preventive measures are not taken.

Farmers can effectively herd waterfowl from rice fields only when the birds have a place to go that provides food. The refuges provide the answer. The Sacramento, Colusa and Sutter National Wildlife Refuges carry on a rice farming program using the same methods as neighboring farmers except for one fact. The ducks and geese rather than the combine do the harvesting. Around 2,000 acres of rice are planted for waterfowl each year on these three federal refuges. Larger acreages of lower-cost foods are also produced. These include barley, wild millet (*Echinochloa crusgalli*), as well as many others.

FIGURE 5. An aerial view of thousands of ducks "stacked in" on a pool of the Sacramento National Wildlife Refuge near Willows, California.

The success of the refuges in holding waterfowl during the crop damage period is illustrated by aerial surveys made of the valley waterfowl population, when in 1954 it was found over 75% of the birds were on the four areas set aside for their use. The danger of damage to the rice crop ceases about November 1, when the harvest is completed. Rice fields have then become converted to stubble fields with much grain having gone to waste. So far as the farmer is concerned at this time, the ducks can invade his fields.

However, this season finds another type of duck herder in the rice fields, the man with the shot gun. Being close to several large cities, the Sacramento Valley has a bontiful supply of hunters. The ducks and geese are for the most part forced to stay behind the closed portions of the refuges. The food supply quickly becomes exhausted. By December two to three million ducks and geese find themselves bottled up in the four Sacramento Valley refuges which offer them less than 10,000 acres of water area. There they glean good patches of every visible seed and grain and end up by eating the straw from the rice as well as the rootstocks of cattail (*Typha* spp.). The most spectacular concentrations of waterfowl to be found in the United States are open for public inspection on these refuges.

Hunters generally agree refuges serve as a reservoir for their sport, and without the refuges waterfowling would be gone in the Sacramento Valley today. In December, the Sacramento Valley, like the Klamath Basin in October, furnishes some of the finest hunting in the United States, but this is generally restricted to those fortunate enough to have a place to hunt. Public hunting areas on the Gray Lodge, Colusa and Sutter areas help care for the average man who does not belong to a hunting club or have an in with a rice farmer. But demands on these areas far exceed the available space, and many hunters have to be turned back.

South of the Sacramento Valley are the Delta and Bay Areas where the Sacramento and San Joaquin Rivers join to become one stream and discharge their waters into the Pacific Ocean. Located in this waterfowl concentration spot is the Suisun Refuge and adjoining Grizzley Island Waterfowl Management Area, both of which are operated by the California Department of Fish and Game.

Still farther south, in that portion of the San Joaquin Valley known as the Grasslands, is another waterfowl concentration area of major importance. The Merced National Wildlife Management Area and the state's Los Banos Waterfowl Management Area are

FIGURE 6. In September as fine a stand of rice that could be seen in the Sacramento Valley was present at the site of this photograph on the Sacramento National Wildlife Refuge. By January, after hordes of ducks and geese consumed the rice grains and finally even the straw, this rice field was turned into the mud flat seen here.

located here. Both of these areas farm millet to feed the birds and keep them from private agricultural crops.

In the Imperial Valley near the Mexican-California line is the Salton Sea National Wildlife Refuge. Here 1,800 acres of barley and other crops planted on the refuge help keep widgeon and geese from the valley's lettuce, alfalfa and other crops. Ponded areas for the production of natural food plants also exist here.

Refuges in other states of the flyway play important roles too. They help deter waterfowl from the problem areas of California, provide shootable populations for the areas they serve, and produce many birds as well. Most of the duck foods in these areas are from natural plants rather than cultivated ones. The Malheur National Wildlife Refuge in Southeastern Oregon, the Bear River Bird Refuge in Utah, and the Stillwater Wildlife Management Area in Nevada are examples of fine natural marshes which are stop-over points in migration as well as breeding areas for both waterfowl and many species of marsh and shore birds. By means of such management tools as manipulation of water levels, muskrats, grazing and controlled burning, the growth of desirable plant species is encouraged and undesirable plants are discouraged. Marsh management is a science of its own.

A continuous program of fact finding is necessary to manage our waterfowl population. Constant surveys of population numbers are carried out. Major concentration areas and northern breeding areas are surveyed by airplanes, often using aerial cameras. Aerial photographs of the last several year's wintering waterfowl population provide the basis for the first really accurate waterfowl population estimates in the Pacific Flyway. Banding answers such questions as the harvest on a given species in addition to tracing migration routes. Upon the findings of these surveys and crop depredation problems are based each year's waterfowl hunting regulations.

Many questions in waterfowl management remain unanswered. More effective controls of avian botulism are badly needed. Every few years thousands of birds succumb to this disease in western alkaline marshes and lakes. Despite considerable research work, much remains to be learned about this disease. The biology and wildlife departments of our colleges and universities could be of considerable service by working on such practical problems as botulism.

Not to be forgotten in the waterfowl program is law enforcement. The U. S. Fish and Wildlife Service has a small but highly effecient force ,of wildlife G-men who work with state game personnel on enforcement problems. Recently a team of these men cracked a market hunting ring in California

which involved eighteen defendants and almost 5,000 ducks.

For the most part, I have covered just one flyway. If you reside in another, you can be sure it has a similar program.

Many of our National Wildlife Refuges are situated near centers of population and schools. They constitute top-notch areas for observing and studying wildlife, and make excellent outdoor laboratories. Outstanding examples include Bombay Hook in Deleware, Chautauqua in Illinois, and Sacramento in California.

To maintain our present waterfowl population for the years to come in the face of increased hunting pressure, is not only going to depend upon breeding ground conditions, but also the continued development and expansion of our refuge system as more and more natural habitat is swallowed up by urban and agricultural development.

Awards for Students in Science and Mathematics

During the coming school year, 140 students throughout the nation will share awards totalling $10,000 in the fifth annual program of Science Achievement Awards. The program is conducted by the Future Scientists of America of the National Science Teachers Association (an NEA department).

The contest is open to all students in grades 7 through 12 in public, private, and parochial schools. Awards consisting of U. S. Savings Bonds, gold pins, certificates, and school trophy plaques will be given for outstanding projects. Honorable mention awards will be granted to several hundred additional students. Equal awards will be given in each of eight geographic regions. The National Association of Secondary-School Principals has placed this contest on the Approved List of National Contests and Activities for 1955-56.

Any project—an investigative problem, a library research, model building, etc.—in general science, biology, chemistry, physics, or any field of science or mathematics at any grade level (7 through 12) is eligible for entry. Special national awards will be given for projects that deal with metals or metallurgy. Project reports must be mailed to Regional Chairman not later than March 15.

The Science Achievement Awards program is sponsored by the American Society for Metals, an organization of professional metallurgical engineers. To participate, students are expected simply to complete and report a science or mathematics project; there are no tests to take and no essays to write. Awards are designed to give recognition for individual student activity and accomplishment and to encourage students to consider careers in science and engineering.

Titles of representative winning projects in the 1955 program of Science Achievement Awards included the following: "The Direct Conversion of Solar Radiation into Electricity"; "How We See Depth"; "What Happens When the Antennae of Insects Are Cut?"; "Spark Testing Metals"; "Geometry in Design"; "Microchemical Analysis of Ore Minerals."

Additional information and student entry forms may be obtained from the Future Scientists of America, National Science Teachers Association, 1201 Sixteenth St., N. W., Washington 6, D. C.

Educational Opportunities

Maybe you missed some excellent educational opportunities this year. Why not look forward to some of these in 1956?

Some opportunities which have come to our attention for teacher and student:

Student scholarship: Several offered each year in biology at Illinois Tech.

Teacher opportunities:

Color-Slide Photography Instruction by Helen C. Manzer of New York in New Hampshire and California this year.

NSTA and the University of Wisconsin on "Keeping Up to Date with the Content and Methods of Teaching Science."

Pennsylvania State University for High School Teachers of Science financed by the National Science Foundation.

Special fellowships available for the

(Continued on page 207)

AAAS Science Teaching Improvement Program

JOHN A. BEHNKE
Associate Administrative Secretary, AAAS

The AAAS Cooperative Committee on the Teaching of Science and Mathematics* has been acutely aware of the rapidly-increasing shortage of science and mathematics teachers and of the inadequacy of the training of many of them. Although most critical in physics, the shortage is general and is growing more serious as school enrollments increase. The Committee has developed a seven-point action program—The Science Teaching Improvement Program—to cope with the problem. With a grant of $300,000 from the Carnegie Corporation and with Dr. John Mayor, mathematician and educator, from the University of Wisconsin as Director, the AAAS hopes to make a real contribution to the alleviation of the situation.

Remedies require an understanding of causes. Four factors stand out in the causal pattern: (1) birth rate changes which are leading to rapidly-expanding enrollment when manpower for teaching must come from the slim depression generation; (2) low salaries of teachers as compared to other opportunities open to them; (3) educational policies and attitudes aimed at the education of everyone with a large increase in terminal training in high school and a decrease in rigor in college-preparatory work; and (4) attitudes of scientists who have been critical of the high schools but have failed to accept responsibility for the recruitment and preparation of high school teachers of science. The program briefly outlined below was designed with these considerations in mind.

I. The AAAS program recognizes the importance to successful teaching of sound and adequate preparation in both subject matter and professional education, but the evidence seems to point to less adequacy of the former than the latter.

State certification requirements and departments of education usually see to it that beginning teachers meet the formal requirements in education. Over the country as a whole there is no comparable insistence upon adequate subject-matter preparation as it is defined by scientists. It is in this area that we think scientists can and should accept greater responsibility and exert greater influence.

In the typical college or university science department, attention has been concentrated on the preparation of students for graduate work and research careers or on the preparation of students for engineering, medical, or other applied science areas. Students with an interest in high-school teaching and with the necessary aptitudes in science and mathematics either have not been encouraged to prepare for teaching or have been discouraged from making such preparation.

How many individuals who might have become satisfactory teachers of high-school science and mathematics have been lost to teaching in this way cannot be calculated. Whatever the past losses, if the situation is to improve, collegiate science departments must actively encourage qualified and interested students to prepare for careers in teaching, both high school and college, but especially high-school. Accordingly, the AAAS plans an

*The Committee includes representatives from the following: American Association of Physics teachers, American Astronomical Society, American Chemical Society, American Geological Institute, American Institute of Physics, American Nature Study Society, American Society for Engineering Education, American Society of Zoologists, Board of Directors of the AAAS, Botanical Society of America, Central Association of Science and Mathematics Teachers, Division of Chemical Education of the American Chemical Society, Mathematical Association of America, National Association of Biology Teachers, National Association for Research in Science Teaching, National Council of Teachers of Mathematics, National Science Teachers Association, Section Q (Education) of the AAAS.

organized effort to bring the facts concerning the critical shortage of high-school teachers of science to the attention of college and university departments of science and mathematics and to urge their more active participation in the recruitment, training, and encouragement of high-school teachers of science and mathematics.

Efforts will be directed where necessary, toward redesigning of under-graduate and graduate science and mathematics programs to provide course work more appropriate for high-school teachers. Too often current offerings are directed toward the preparation of research scientists, doctors and engineers. Such curriculums have driven teachers to take even more of their work in education than actual requirements demanded. Special science courses, open only to teachers, are especially needed in summer programs where prerequisites often prevent teachers from obtaining the kind of enrichment in subject matter that they need.

If these efforts are to be effective, scientists must work with departments of education and state school officials for the revision of certification requirements to place greater stress on subject-matter preparation of prospective teachers.

II. A large potential source of high-school teachers of science and mathematics consists of individuals who have had college work in these fields, who may be interested in teaching, but who lack the required courses in education. Such individuals are found among seniors in liberal arts, engineering, premedical, predental, and other curriculums; some of the students who started to specialize in these other fields later developed an interest in teaching, but made that change too late in their college careers to take the usual sequence of courses in education without unduly lengthening their college programs. Similarly, among college graduates with substantial amounts of work in the sciences and mathematics may be found some who would like to teach.

Special accelerated programs in education should be arranged for senior undergraduate students who wish to qualify for teaching positions before the beginning of the next academic year. For students in independent liberal arts colleges without departments of education, cooperative arrangements with departments of education in nearby institutions may need to be worked out. In any case, institutions of higher education should take the initiative in setting up such accelerated programs and in bringing them to the attention of interested students.

The AAAS plans to study the effectiveness of tapping these resources of potential science and mathematics teachers, to collect information on what is already being done toward that end by individual institutions, and to hold a series of state conferences of scientists, educators, and state certifying officials to stimulate additional efforts toward the development of emergency programs for the training of science and mathematics teachers.

III. Steps will be taken to develop a vigorous program for the recruiting of future teachers. Among these will be: (a) the preparation and dissemination of appropriate guidance materials on mathematics and science teaching; (b) the promotion of vocational guidance programs through assemblies, radio, and television; (c) the utilization of scientists and engineers as counselors of students with scientific interests; and (d) the encouragement of high-school science clubs, science fairs, and junior academies of science.

An important element in the development of a recruiting effort is knowledge of what it is that people find attractive and unattractive in the field for which one is recruiting. Some of these factors are already known insofar as they concern the field of teaching, but current and better information is desirable. Consequently the AAAS plans to make a study both of the factors that attract people into teaching, and of the factors that are important in influencing teachers to turn to other kinds of work. The information from the study can be used, not only in guidance and recruiting, but also, to some extent, in suggesting changes in school policies and arrangements that would make teaching more attractive.

IV. At the root of much of the difficulty of attracting and retaining competent teachers are the prevailing low salary scales and the deterioration in the relative economic position of teachers with respect to other occupational groups. Although all teachers are affected by these economic factors, the problem arises most acutely in the recruitment and retention

of science and mathematics teachers. Industry and government compete more aggressively for persons with training in science and mathematics than they do for prospective teachers in other fields.

We support the principle that beginning salaries, rates of salary advance, and salary ceilings for teachers should be comparable to those available to other professional personnel of equivalent training. Since local action will be extremely important in meeting this problem, AAAS will plan to work through its members, its affiliated and associated societies, and especially through the academies of science.

Studies will be made of possible ways to increase the financial attractiveness of teaching, such as, year-round employment, summer employment in science-related industries, or additional pay for directing student research, science clubs, etc.

V. To a considerable extent, the large size of classes, heavy teaching loads, and lack of adequate laboratory facilities and instructional equipment discourage competent students of science and mathematics from looking forward to careers as teachers. These same factors contribute to the high rate at which teachers of science and mathematics leave teaching for other occupational fields.

The AAAS, both as an association and through its individual members, can bring to the attention of appropriate groups the need for improving the conditions under which science teachers work. It will investigate the effectiveness of the use of teaching assistants and of such instructional aids as motion pictures, radio and television in increasing teaching efficiency and providing the teacher with more attractive working conditions. It will give special attention to the adjustment of teaching load, so that a more effective job can be done, particularly in connection with laboratory instruction.

VI. In recent years the secondary-school teacher has not enjoyed high prestige, not by any means, we think, as high as his contribution to society merits. The public recognition of exceptionally able teachers of science and mathematics represents one means of enhancing their prestige. The AAAS therefore plans to institute an annual program of awards to outstanding teachers. The teachers to be honored will be those who, over a period of years, have been recognized in their schools and communities as exceptionally effective, whose knowledge of science or mathematics approximates that of a master's degree level and who have, through writing or other means, been of substantial help to their fellow-teachers. We propose to honor them with citations as Distinguished Service Teachers. Since these citations are intended not only to reward excellence but also to call public attention to the importance of good teaching, the citations will be awarded in the teachers' own schools and will be given national publicity.

Intelligently administered, rank and honors are not only an award to those who receive them but an inspiration to those who aspire to them. For many individuals, and particularly those who are sincerely attracted by the opportunity to guide the intellectual development of young people, the respect accorded the teacher may provide the best measure of the value that society places on teaching.

VII. Since in the years ahead, we shall be forced to employ many inadequately-prepared teachers, the AAAS plans to try an experiment in the "Upgrading" of relatively inexperienced and inadequately-prepared teachers.

The plan provides for the employment in each of several geographic regions of two competent science or mathematics teaching counselors—expert consultants—who will tutor, assist, and serve as a source of information and help to the less-experienced and less-competent science teachers of the region. These consultant teachers would have no administrative supervision over their colleagues and would be employed only in regions in which supervisory help in science and mathematics is not already available within a school system.

It is hoped that the experiment will prove successful enough to encourage school systems, state departments of education, and colleges and universities to assume permanent responsibility for providing continuing consultant services in science and mathematics to nearby high-school teachers of those subjects.

There are so many facets to the problem of bringing about a sizable increase in the supply of well-prepared high-school teachers of science and mathematics, and of improving high-school teaching in these fields, that the AAAS cannot hope to achieve any large

measure of success without the concurrent efforts of many other groups and organizations. Although it will supplement and sometimes cooperate with other programs looking toward the same ends, the AAAS will concentrate its major effort on the projects that it is particularly well qualified to carry out by virtue of its broad representation of scientists and science teachers in all the sciences on all levels.

Requests for information or for copies of the pamphlet, "Science Teaching Improvement Program," which describes these projects in somewhat more detail should be directed to the American Association for the Advancement of Science, 1025 Connecticut Avenue, N.W., Washington 6, D. C.

Biology in the News

BROTHER H. CHARLES, F.S.C.
St. Mary's College
Winona, Minn.

THE WORLD OF INSECTS, *Life*, Aug. 8, 1955, pp. 43-55.

Marvelous pictures of insects and their activities, and captions which give a maximum of interesting information in a small space. Good bulletin board material. You will want several copies for your permanent files.

FOREST FIRE, ROBERT DE ROOS AND ALVA NEUNS, *Collier's*, July 22, 1955, pp. 25-29.

An account of present methods for spotting fires and fighting them, built around the Jameson fire. The effects of such fires on soil and water conservation and on wild life is difficult to estimate since it may take a century for the region to recover.

THE BIG SPLASH IN TROPICAL FISH, pictures by Jerry Yulsman, *Collier's*, Aug. 19, 1955, pp. 28-33.

Excellent pictures and descriptions of tropical fish. Good bulletin board material.

LET THOSE CRASH VICTIMS LIE! Greer Williams, *Saturday Evening Post*, Aug. 20, 1955, pp. 22-23, 45-48.

Most well-meaning efforts to move people who are seriously injured harm the victims. This article can be used effectively to induce students to learn and practice proper first aid.

I LIVED WITH THE BEARS, Cecil Rhode, *Outdoor Life*, Sept. 1955, pp. 34-37, 66-67, 74-76.

Closeup pictures and an interesting account of the activities of the big Alaskan brown bears.

THE FISH, James Dugan, *Collier's*, Sept. 16, 1955, pp. 64-68.

Coelacanths lived at the time of the dinosaurs. We have excellent fossil remains of them. This is an account of living coelacanths which have been caught off the coast of Madagascar in the past ten years.

SEND FOR AN AMBULANCE, Samuel Grafton, *Good Housekeeping*, Sept. 1955, pp. 56-59, 238-245.

To handle the sick and injured properly, to prevent further injury during transit to the hospital or home, to calm fears and to cheer people are routine for men who operate ambulances. This article might stimulate students to appraise the ambulance service in their city or town.

THE MIRACLE MAKERS, Don Short, *Cosmopolitan*, Sept. 1955, pp. 58-61.

Burns cause more home accident deaths than any other type of injury except falls. Doctors at the Brooke Army Medical Center are finding better and better ways to save the lives of seriously burned people.

WE SAVED THE LIVES OF 22 CHILDREN, Llewellyn Miller, *Redbook*, Sept. 1955, pp. 28-31, 82-84.

Rabies can appear in any community. What Gary, Indiana did when a rabid young dog bit several persons, most of them school children, shows how cooperation of people can save lives and dispel fear.

YOU CAN SAVE YOUR TEETH, Lester David, *Cornet*, Sept. 1955, pp. 101-104.

New dental techniques are saving teeth by preventing caries in the young and by new methods of filling cavities and curing mouth infections.

A June 6, 1955 Selective Service bulletin says that local boards should give careful consideration to the occupational deferment of a science or mathematics teacher.

THE NOMINATING COMMITTEE REPORTS

For President-Elect

John Breukelman

A.B., Yankton College, M.S., Ph.D., State University of Iowa, public school teacher in South Dakota for four years, Head of Department of Biology at Kansas State Teachers College of Emporia since 1929, Acting head of graduate division from 1944 to 1947, author of about 30 educational and scientific articles, exclusive of editorials and book reviews, charter member of NABT, vice president in 1954, editor-in-chief of ABT from 1942 to 1953, on staff of 1954 Florida Conference, chairman of steering committee of 1955 Michigan Conference, served on various committees and activities of NABT since its organization.

For President-Elect

Edna Higbee

University School, Pittsburgh, Pennsylvania, B. S.; M.S.; Ph.D., University of Pittsburgh. Has taught in high Schools and St. John's Academy, graduate assistant in zoology and biology, lecturer in biology at the University of Pittsburgh. Research worker at St. Margaret's Hospital, Pittsburgh. Since 1944 has been Principal, head of Biology department, and Dean of Women at University School. Was president of the Biology Club of Southwestern Pennsylvania for seven years. Vice President West of the Pennsylvania Academy of Science. Active in membership work for NABT. Member of many professional organizations. Dr. Higbee has been editor of *The Biologist*. Her professional field of interest has been in experimental morphology and has published several articles for professional journals. Dr. Higbee has been listed in several standard reference works on educational and science leaders. She is the present first vice president of NABT.

For First Vice President

Irene Hollenbeck

Southern Oregon College of Education, Ashland, Oregon. Twenty years experience as a high school biology teacher. Helped to prepare the course of study in biology now in use in Oregon. While teaching high school students she experimented with methods and materials for the superior student in biology, and with methods and materials for the retarded. Her students have been winners of FSA and Westinghouse Talent Search awards. Charter member of NABT. Present state conservation chairman and regional membership chairman. Has served in the past on the textbook evaluation committee, on the National Conservation Project committee, and as state membership chairman. Member of NSTA (serving on national committee on biology teaching), American Association for the Advancement of Science, and the Oregon Academy of Science, Phi Beta Kappa, Phi Kappa Phi, and Pi Lambda Theta. Publications: Co-author of the monograph: "Selected Procedures for Teaching Biology"; professional articles in The American Biology Teacher, The Science Teacher, Science Education, and Selected Science Teaching Ideas of 1952. Winner of an NSTA Teacher Award, 1952. Recipient of a Ford Foundation Fellowship (Fund for the Advancement of Education) 1953-54.

For First Vice President

Mrs. Gordon Brown

Training: Graduated from the State Teachers College, Radford, Virginia with a Bachelor's degree in scientific supervision and from Emory University, Atlanta, Georgia with a Master of Arts degree in biology. Studied in the graduate schools at the University of Virginia Columbia University, George Washington University, the University

(Continued On Next Page)

of Georgia, and at Emory University since receiving master's degree. Experience: From 1929 until named Science Coordinator in 1947, taught chemistry, human biology, and zoology at Girls' High School in Atlanta, Georgia. In addition, has taught science education classes in summer schools and workshops at Radford Teachers College, Radford, Virginia, in Duval County Schools, Jacksonville, Florida and at Emory University, Atlanta, Georgia. In each summer position, the program was offered to teachers of science. Served as a member of the advisory committee preparing new science tests during the summer of 1955 for Educational Testing Service. Publications: History of Radford, Virginia, Life History of *Nassula ambigua minor*, was asked to revise *The Human Body* by Best and Taylor—Articles in science education journals. Organizations: Member of: Phi Sigma (honor biology society) Alpha Chapter of Delta Kappa Gamma, Kappa Delta Epsilon, and Alpha Xi Delta. Fellow in the Georgia Academy of Science having served on the Executive Council of the Academy; is a member of the American Academy for the Advancement of Science, a member of the National Association for Research in Science Teaching, has served as Southern Regional Director of the Board of Directors and chairman of the Health Committee of the National Science Teachers Association, and is a member of the American Association of University Women. State Chairman of the Conservation Project sponsored by the National Association of Biology Teachers, 1952-53; a member of the Thomas Alva Edison Institute, 1951; consultant at the Conference of Cooperative Committee on Science and Mathematics Teachings sponsored by the American Academy of Science and the United States Office of Education in 1952; consultant for the supervisory group at the 1953 National Science Teachers Association, and chairman of the School Health Committee, Atlanta Tuberculosis Association, 1952-53. Served as overall chairman of the committees which planned and staged the Southern Regional Conference of National Science Teachers Association, which was held in Atlanta in October, 1952 and am general local chairman of the NABT, ANSS and NSTA committee for the December, 1955 meetings in Atlanta. Was invited to participate in the Southeastern Work Conference on Biology Teaching which was held in Gainesville, Florida in August, 1954. Professional Contributions: Major addresses at meetings of: National Association of Biology Teachers; National Science Teachers; Cooperative Committee of AAAS and others. Helped plan and develop a Workshop for Science Teachers and a Health Seminar for Teachers and Nurses at Emory University. Science Coordinator for Atlanta High Schools, Atlanta, Georgia. There are seventeen community high schools in Atlanta. Duties include various ways of improving science instruction, and acting as liaison between teachers and scientists in the community.

For Second Vice President

Samuel L. Meyer

Samuel L. Meyer was born on a farm near Steinmetz, Missouri, on November 9, 1906. He attended the public schools at Fayette, Missouri, and graduated from Fayette High School in 1926. After receiving the A.B. degree from Central College, Fayette, Missouri, in 1930, he graduated from Vanderbilt University with a M.S. degree in 1932 and from the University of Virginia with the Ph. D. degree in 1940. In 1953, he was awarded an honorary degree of Doctor of Laws by Central College. Broadly trained as a biologist and greatly interested in the improvement of teaching biology at the college level, Dr. Meyer has taught at Central College (1930-31), Vanderbilt University (1932-36), the University of Virginia (1937-40), the University of Tennessee (1940-43, 1946-51), Emory University (1945-46), and the Florida State University (1951-52, 1953 to the present). Dr. Meyer is a veteran of World War II. His principal duty assignment was at the Army School of Malariology, Fort Clayton, Panama Canal Zone. In 1952-53, Dr. Meyer served as the Executive Director of the American Institute of Biological Sciences and Executive Secretary of the Division of Biology and Agriculture of the National Research Council. At the present time, he is Professor and Head of the Department of Botany and Director of the Oceanographic Institute at the Florida State University. He is the author of the botanical articles in *The Grolier Encyclopedia*, published in 1949 by the Grolier Society of New York, as well as a number of scientific and popular articles on a wide variety of biological subjects. Dr. Meyer is active in a number of scientific and learned societies. At the present time, he is Chairman of the Southeastern Section of the Botanical Society of America; National Vice-President of Phi Sigma, biological honorary society; and Vice President of the Florida Association of Science Teachers. He is a Fellow of the AAAS, a past President of the Association of Southeastern Biologists and the Tennessee Academy of Science and a member of the American Bryological Society, the NABT, the Florida Academy of Sciences, Omicron Delta Kappa, Sigma Xi, Phi Kappa Phi, and Phi Beta Kappa. He served as a Co-Director of the Southeastern Conference on Biology Teaching held in Gainesville last September and is a member of the Steering Committee for the North Central States Conference. He has published two articles in *The American Biology Teacher* (Vol. *15*, pages 95-97, 1953; Vol. *16*: 173-176, 1954).

Second Vice President
(Continued)

Howard E. (Howdy) Weaver

Position: Assistant Professor, University of Illinois, heading up instruction in outdoor education. Academic training: B.S. Purdue; M.S. Ed. and PhD; Cornell Univ. Publications: Two books, a bulletin, and several technical papers. Work in NABT: Regional chairman for Southwest; played active role in the development of the NABT's *Conservation Handbook;* served in NABT board meetings in Cleveland, Boston, St. Louis, and Berkeley.

For Third Vice President

Robert Smith

Born — Providence, Illinois, June 21, 1915, son of Congregational Minister. Married in 1939. Have two daughters and one son. Will have a "new addition" in October. Attended grade school and high school at East Aurora High school, Aurora, Illinois. Mother died in 1931 and I finished high school at LeRoy, Illinois, (Empire Twp. High School) graduating in 1934. Graduated from Illinois State Normal University, majored in Biology in 1938 with a Bachelor of Education. While there won 12 letters in track and cross country. Member of three State Champion Cross Country Teams, Captaining the 1937 team. State College Mile Champion in 1935. Taught and coached at the Thompsonille High School, Thompsonville, Illinois and then went as a biology teacher to Herrin, Illinois in 1941 with Cross Country Coaching on the side. Also became Chairman of Judging in the Illinois Jr. Academy of Science in 1941. Served in the South Pacific as a parasitologist in an Army Laboratory from 1942 through 1945 being on the New Hebrides, the Philippines, and Japan. Taught at the U. of Michigan on an Assistantship in the Spring term, 1946 and then went back to Herrin in the fall of 1946. In 1947 became Assistant State Chairman of the Illinois Junior Acad. of Science and from 1949 to 51 I headed the Illinois Junior Academy of Science as State Chairman. In 1951 I moved to DeKalb High School as Chairman of the Biology Department and cross country coach. In 1951 also became State Chairman of the NABT Conservation Project and Regional Chairman in 1953. Also became a regional membership chairman in 1953 and the National Membership Chairman of NABT in 1955.

For Secretary-Treasurer

Paul V. Webster

Biology instructor, Bryan High School, Bryan, Ohio; A.B. in Zoology, B.S. in Education, M.A., The Ohio State University. Member of numerous educational and scientific organizations. Ohio membership chairman for three years. Has attended all the national meetings since joining. Has been secretary-treasurer since 1954.

Constitution Revisions

During the Executive Board meeting at the North Central Conference at Douglas Lake, the constitution revisions which were published in the November issue of the AMERICAN BIOLOGY TEACHER, were accepted with the following changes. These are presented for membership consideration at this time. Any comments or criticisms should be sent to our secretary, Paul Webster, Bryan City High School, Bryan, Ohio.

Present Form

Article III

SECTION 1. Membership in this association shall be open to all who are interested in the teaching of biological science. There shall be two classes of membership, regular and sustaining members.

Article IV

SECTION 3. Executive Board. This board shall consist of the executive officers, the editor-in-chief of the journal and the managing editor.

Proposed Changes

Article III

SECTION 1. Membership in this association shall be open to all who are interested in the teaching of biological science. There shall be three classes of membership, regular, sustaining, and life members.

Article IV

SECTION 3. Executive Board. This board shall consist of the executive officers, the editor or editors-in-chief, and the managing editor of the journal.

BY LAWS

Article IV

Officers and Boards of the Journal

SECTION 1. The official journal shall be controlled by an editorial board consisting of an editor-in-chief, a managing editor and a number of associate editors. The editor-in-chief shall be chairman of the editorial board. The members of the editorial board shall be appointed by the Board of Directors. At least one-half of the editorial board shall be classroom teachers of biology below the college level.

Article VI

Officers and Boards of the Journal

SECTION 1. The official journal shall be directed by the members of the editorial board with executive responsibility. These shall include the editor-in-chief or co-editors and the managing editor appointed by the Board of Directors.

Books for Biologists

GREAT EXPERIMENTS IN BIOLOGY. Gabriel, M. L. and Fogel, S. 317 pp. $3.95. Prentice-Hall, Inc., Englewood Cliffs, N. J. 1955.

This book is the outgrowth of a conviction that an important means of inculcating awareness of science as a process lies in the presentation of original scientific writings. The editors have chosen less than a dozen areas in general biology in which significant progress has been made and for each of these fields have selected a sufficient number of classic papers to show the milestones in the advance of knowledge. Many are the rewards of these firsthand contacts with the classic treasures of scientific writings: Brown, Schwann, Warburg, Pasteur, Darwin, Went, Hill, Weismann, Mendel, to mention a few.

THE GIFTED STUDENT AS FUTURE SCIENTIST. Paul F. Brandwein. 107 pp. $1.50. Harcourt, Brace and Company, New York, New York. 1955.

The purpose of this book is sixfold. First is the formulation of a conceptual scheme which may be useful in determining the nature of giftedness or high ability in science. Second is a program to stimulate the development of youngsters with high ability. Third is a description of tests to identify these youngsters. Fourth is an attempt to describe their behavior. Fifth is an attempt to describe a teacher successful in working with these youngsters. Sixth are some proposals concerned with specific problems on the local level. This book should be a valuable aid to all teachers dealing with gifted youngsters.